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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/730,526	12/05/2003	Naoto Morikawa	60414 (47793)	2955
21874	7590	08/31/2005	EXAMINER	
EDWARDS & ANGELL, LLP P.O. BOX 55874 BOSTON, MA 02205			PRENDERGAST, ROBERTA D	
			ART UNIT	PAPER NUMBER
			2671	
DATE MAILED: 08/31/2005				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/730,526

Applicant(s)

MORIKAWA, NAOTO

Examiner

Roberta Prendergast

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 March 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 05 December 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 12/5/2003.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Drawings

Figures 17-26 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated, i.e. Figs. 17-26 are disclosed in the background as describing the prior art polygon-mesh and CSG methods. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the examiner does not accept the changes, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

The drawings are further objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: for example, Fig. 4 step S230, Fig. 10 element 14, Figs. 12-13, and various other elements were not disclosed and further Figs. 27-28 were disclosed but are not found in the application. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of

an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the examiner does not accept the changes, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 5 and 6 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Referring to claims 5 and 6, a shape processing program for imitating or reproducing the shape of an object in a three-dimensional space is not claimed as embodied in a computer readable media.

Data structures not claimed as embodied in computer-readable material are descriptive material *per se* and are not statutory because they are not capable of causing functional change in the computer. Such claimed data structures do not define any structural and functional interrelationships between the data structure and other claimed aspects of the invention, which permit the data structure's functionality to be realized.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-7 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1, 2, and 5-7 recite the limitation "...sets two sides of the reference body in a twisted position ..." in the 5th line of the second paragraphs, it is unclear as to what applicant means by the terms twisted position. Examiner assumes that applicant is referring to an angled position wherein the sides indicate the front and back of a tetrahedral. Further clarification is required.

Claims 3 and 4 are dependent on claims 1 and 2 and therefore the same rejections apply.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 2, 5, and 6 are rejected under 35 U.S.C. 102(b) as being anticipated by Meshkat U.S. Patent No. 5553206.

Referring to claim 1, Meshkat teaches a shape processor for imitating the shape of an object in a three-dimensional space (column 4, lines 34-38, i.e. the shape processor system is a graphics system having finite element analysis capability with the means for performing the method being described) comprising: a reference information acquiring unit for acquiring reference body information for specifying the shape of reference body which is a tetrahedron composed of four identical faces, side setting information for setting two sides of said reference body in a twisted position as first and second sides, and face setting information for setting two faces sharing said first side of said reference body as first and second faces (Figs. 4A and 4B; column 5, lines 26-35 and 49-67; column 6, lines 1-7 and 36-67, i.e. quadrilateral pairs of ; column 7, lines 30-62, i.e. tetrahedral ABCE is comprised of a front side with two faces ABC and BCE sharing an edge BC and a back side with two faces CAE and BAE sharing an edge AE, tetrahedral BCDE is comprised of a front side with two faces CDE and BDE sharing an edge BD and a backside with two faces BCD and BCE sharing an edge CE, it is

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understood that a system having processing capabilities for acquiring reference information is comprised of a reference information acquiring unit); an approximating unit for imitating the shape of an object using said reference bodies, by putting said first side of said first reference body on said second side of said second reference body and putting either said first or second face of said first reference body on the corresponding face of said second reference body, according to the information representing the shape of the object and the information acquired by said reference information acquiring unit (Fig. 4A and 4B; column 7, lines 30-62, i.e. the front side of tetrahedral ABCE is placed on the second side of tetrahedral BCDE at the common edge BC and the second face BCE of tetrahedral ABCE is placed on corresponding face BCE of tetrahedral BCDE and the common faces are merged to create a quadrilateral face pair comprised of faces ABC and BCD, it is understood that a system having processing capabilities for acquiring approximation information is comprised of an approximating unit); and an approximation information storage unit for storing approximation information representing which of said first and second faces of said first reference body is put on the corresponding face of said second reference body (Figs. 4A and 4B, 10, 13 and 14; column 7, lines 30-62; column 8, lines 1-44; column 10, lines 8-53, i.e. it is understood that a system having processing capabilities for acquiring all of the information described above is comprised of an approximation information storage unit for storing approximation information in the search trees and graphs described by Meshkat).

Referring to claim 2, the rationale for claim 1 is incorporated herein, claim 2 recites the elements in claim 1 (i.e. the reproducing unit of claim 2 is understood to be the approximating unit of claim 1) and therefore the same rejections apply.

Referring to claim 5, the rationale for claim 1 is incorporated herein, Meshkat teaches a shape processing program for imitating the shape of an object in a three-dimensional space, the shape processing program comprising a reference information acquiring module, an approximating module, and an approximation information storage module for performing the shape processing steps described in claim 1 above (Fig. 17; column 4, lines 39-46, i.e. it is understood that a computer program product including a recording medium and instructions, recorded on the medium for directing the processing system to execute the method of Meshkat is comprised of a reference information acquiring module, an approximating module, and an approximation information storage module for directing the reference information acquiring unit, approximating unit, and approximation information storage unit of claim 1 to perform their respective functions).

Referring to claim 6, the rationale for claim 2 is incorporated herein, Meshkat teaches a shape processing program for reproducing the shape of an object in a three-dimensional space, the shape processing program comprising a reference information acquiring module, an approximation information storage module, and a reproducing module for performing the shape processing steps described in claim 2 above (Fig. 17; column 4, lines 39-46, i.e. it is understood that a computer program product including a recording medium and instructions, recorded on the medium for directing the processing system to execute the method of Meshkat is comprised of a reference information

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acquiring module, an approximation information storage module, and a reproducing module for directing the reference information acquiring unit, approximation information storage unit, and reproducing unit of claim 2 to perform their respective functions).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meshkat U.S. Patent No. 5553206 in view of Applicant's admitted prior art (APA).

Referring to claims 3 and 4, the rationale for claims 1 and 2 is incorporated herein, Meshkat teaches a shape processor as claimed in claims 1 and 2, wherein said reference information acquiring unit acquires reference body information which specifies a tetrahedron but does not specifically teach wherein the tetrahedron are composed of such four identical isosceles triangles that the ratio of length of its sides is $2 : \sqrt{3} : \sqrt{3}$.

Applicant's APA teaches wherein the tetrahedron are composed of such four identical isosceles triangles that the ratio of length of its sides is $2 : \sqrt{3} : \sqrt{3}$ (page 1, RELATED ART, paragraph [0003]; page 11, SUMMARY OF THE INVENTION, paragraph [0052]; page 22, DETAILED DESCRIPTION OF THE INVENTION, paragraph [0132]).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system and method of Meshkat to include wherein the tetrahedron are composed of such four identical isosceles triangles that the ratio of length of its sides is $2 : \sqrt{3} : \sqrt{3}$ because such tetrahedrons can be fitted together to fill a three-dimensional space without overlaps and gaps.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Meshkat U.S. Patent No. 5553206 in view of Applicant's admitted prior art (APA) as applied to claims 1-4 above, and further in view of Schaedel U.S. Patent No. 6264199 and Rossignac et al. U.S. Patent No. 5825369.

Referring to claim 7, the rationale for claims 1-4 are incorporated herein, Meshkat, as modified above, teaches a shape encoding method which encodes the shape of a given object in a three-dimensional space by representing the relation among reference bodies obtained by dividing the object wherein each reference body is a tetrahedron composed of such four identical isosceles triangles that the ratio of length of its sides is $2 : \sqrt{3} : \sqrt{3}$, connecting each reference body with another one or two reference bodies, and describing which face of said reference body is in contact with the corresponding face of said following reference body (see the rationale for claims 1-4 above) but does not specifically teach wherein the method comprises the steps of encoding the shape into a sequence of 0 and 1 using reference bodies where each reference body is a tetrahedron composed of such four identical isosceles triangles that the ratio of length of its sides is $2 : \sqrt{3} : \sqrt{3}$; connecting each reference body with another one or two reference bodies to form a chain at the longer

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edges in such a way that two faces of a reference body can be brought into contact with the corresponding faces of the following reference body, one pair at a time, by rotation around the longer edge shared by the two reference bodies; encoding the shape by specifying the folding of the chain, i.e., the folding at each longer edge between two consecutive reference bodies in said chain; assigning the values of 0 and 1 to the two faces of said reference body which share a longer edge, 0 for a face and 1 for the other, in advance; and using the values to describe the folding at the longer edges, that is, which face of said reference body is in contact with the corresponding face of said following reference body.

Schaedal teaches using reference bodies where each reference body is a tetrahedron composed of such four identical isosceles triangles (column 2, lines 37-46 and 53-67; column 3, lines 48-52; columns 5-6, lines 64-7, i.e. all-space filling); connecting each reference body with another one or two reference bodies to form a chain at the longer edges in such a way that two faces of a reference body can be brought into contact with the corresponding faces of the following reference body, one pair at a time, by rotation around the longer edge shared by the two reference bodies; encoding the shape by specifying the folding of the chain, i.e., the folding at each longer edge between two consecutive reference bodies in said chain (column 6, lines 8-25, i.e. each pair of tetrahedrons will fold along their common base edge); assigning the values of 0 and 1 to the two faces of said reference body which share a longer edge, 0 for a face and 1 for the other, in advance (Figs. 20-21; column 10, lines 18-26, i.e. plus and minus are understood to be 1's and 0's); and using the values to describe the folding at

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the longer edges, that is, which face of said reference body is in contact with the corresponding face of said following reference body (Figs. 20-21; column 10, lines 18-26, i.e. self-attracting indicates that the plus faces are attracted to the minus faces indicating that the reference bodies should be folded in such a way as to allow these faces to touch).

Rossignac et al. teaches wherein the method comprises the steps of encoding the shape into a sequence of 0 and 1 using reference bodies (Figs. 6, 8, 9, 17, and 18; column 5, lines 21-40; column 6, lines 4-32; column 12, lines 20-30); connecting each reference body with another one or two reference bodies to form a chain (Figs. 9C and 15 (element 15500)); encoding the shape by specifying the folding of the chain, i.e., the folding at each longer edge between two consecutive reference bodies in said chain; assigning the values of 0 and 1 to the two faces of said reference body which share a longer edge, 0 for a face and 1 for the other, in advance (column 9, lines 43-52, i.e. it is understood that A and B can be represented as 1 and 0 and a marching record indicates which faces are to be connected).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system and method of Meshkat to include wherein the method comprises the steps of encoding the shape into a sequence of 0 and 1 using reference bodies where each reference body is a tetrahedron composed of such four identical isosceles triangles that the ratio of length of its sides is $2 : \sqrt{3} : \sqrt{3}$; connecting each reference body with another one or two reference bodies to form a chain at the longer edges in such a way that two faces of a reference

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body can be brought into contact with the corresponding faces of the following reference body, one pair at a time, by rotation around the longer edge shared by the two reference bodies; encoding the shape by specifying the folding of the chain, i.e., the folding at each longer edge between two consecutive reference bodies in said chain; assigning the values of 0 and 1 to the two faces of said reference body which share a longer edge, 0 for a face and 1 for the other, in advance; and using the values to describe the folding at the longer edges, that is, which face of said reference body is in contact with the corresponding face of said following reference body thereby providing for the construction of a great variety of different shapes for educational and entertainment purposes and for allowing the tetrahedral chains to form various random solid shape that are all-space filling with no irregular gaps or voids between or among the surfaces of the contracted shape (column 1, lines 10-15 and 59-65) and further because binary encoding provides a method of representing the connectivity information without loss of information in a compressed form (column 5, lines 42-55).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following U.S. Patents are cited to further show the state of the art with respect to shape processing.

Freedman U.S. Patent No. 3662486

Meshkat U.S. Patent No. 4933889

Schroeder U.S. Patent No. 5561749

Rossignac et al. U.S. Patent No. 5905507

Fish et al. U.S. Patent No. 5982385

Kumar et al. U.S. Patent No. 5999188

Gueziec et al. U.S. Patent No. 6307551

Bossen et al. U.S. Patent No. 6445389

Gueziec et al. U.S. Patent No. 6452596

Venkataraman et al. U.S. Patent No. 6501471

The following Foreign Patents are cited to further show the state of the art with respect to shape processing.

Pavlov Document ID No. RU 2040292 C

Ortolf Document ID No. DE 196 17 526 A1

Pfeffer et al. Document ID No. EP 517872 B

The following Non-Patent Literature is cited to further show the state of the art with respect to shape processing.

Pajarola et al., "Implant sprays: compression of progressive tetrahedral mesh connectivity", *Proc. Conf. on Visualization '99: Celebrating Ten Years*, IEEE Computer Society Press, pp. 299-305.

Ueng et al., "An out-of-core method for computing connectivities of large unstructured meshes". (Sept. 9-10, 2002). *ACM Int'l Conf. Proc. Series*, vol. 29. pp. 97-103.

Gumhold et al., "Tetrahedral mesh compression with the cut-border machine", *Proc. Conf. on Visualization '99: Celebrating Ten Years*, IEEE Visualization, IEEE Computer Society Press, pages 51-58.

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Szymczak et al., "Grow & fold: compression of tetrahedral meshes", *Proc. of the 5th ACM Symposium on Solid Modeling and Applications* (June 8-11, 1999), ACM Press, NY, NY, pp. 54-64.

Glassner, A.S. , "A shape synthesizer", *Computer Graphics and Applications*, IEEE, May/Jun 1997, Volume: 17, Issue: 3, page(s): 40-51.


Taubin, G. and Rossignac, J. 1998, "Geometric compression through topological surgery", *ACM Trans. Graph*, Vol 17, 2 (Apr. 1998), 84-115.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Roberta Prendergast whose telephone number is (571) 272-7647. The examiner can normally be reached on M-F 7:00-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on (571) 272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

RP


ULKA J. CHAUHAN
PRIMARY EXAMINER